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(54) **Method for generically describing measured results.**

(57) A method for generically describing measured results which includes defining a class of entities to be measured, and a set of criteria which distinguish entities within the class of entities to be measured. A computer display format is dynamically configured based on the set of criteria. The set of criteria is displayed on the computer display (31) according to the computer display format. The values related to an individual entity are interactively specified. The set of measurements related to class of entities to be measured is displayed on the computer display screen and are associated with the set of criteria.

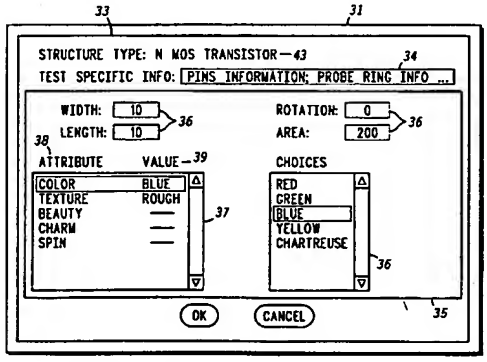

FIG. 2

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Field of the Invention

The present invention relates, in general, to methods for organizing experimental results, and more particularly to a method for building a generic database of experimental measurements.

Background of the Invention

In commercial settings, engineering databases are available to engineers for analysis using a data analysis component related to the system. Measured values are typically stored in such a database by tagging them with a unique identifier known as a parameter. Each parameter has a name and number associated with it. The parameters describe data and conditions under which it was collected and also associate the data with the particular test equipment used.

The number of unique parameters measured for storage and analysis in a typical commercial laboratory database is in excess of 50,000. The number of stored measurements for these parameters exceeds fifty million. New parameter definitions are created at the rate of hundreds or thousands per week. Methods of defining and enforcing standards for these large numbers of parameters are absolutely essential in order to produce high quality analysis and transfer of meaningful information between engineering groups. The tools available in the prior art for defining and maintaining parameter definitions were insufficient for this challenge.

There is a need for a method for gathering, storing, and analyzing large amounts of engineering data in an organized fashion. This method should be usable at many sites and have flexible configuration options. Ideally, system configuration should consist of loading information into standard database tables. As a result the configuration should define the relationships between the system components as well as the behavior of individual system components.

Brief Description of the Drawings

FIG. 1 shows a schematic diagram of a database system;

FIG. 2 shows a typical dialog screen used to collect information for the system of FIG. 1; and

FIG. 3 shows a matrix display of a typical structure and test matrix used by the system of FIG. 1.

Detailed Description of the Drawings

FIG. 1 is a schematic diagram which shows a database system. Files 14 are generated by test engineering which reflect the criteria for testing the product. Files 14 identify testing options available for a product or process structure for making the product. Each product has an associated measurement set, and each process structure for making the product has an associated measured entity. A load test program 13 translates these files into a form suited to a database 12. Load test program 13 inserts the various testing options for each product and structure type into database 12. Database 12 acts as a central repository for all information pertaining to products and structure types. The stored information includes: a set of criteria which differentiate individual product and processing entities within a structure class, formatting of parameter names, limit data, and testing options. A configuration program 11 interacts with configuration files 18 to retain a set of information depicting a formulated parameter name and associated test description for each measurement or measured entity. Information from the configuration files is extracted to form a generic test description 15. A test generator 16 uses generic test description 15 to generate a test program 17 which is appropriate for the process and product entity being tested. A load parameter program 21 uses configuration files 18 to extract information from database 12 concerning the test description and selected testing options for a particular product and processing entity. Load parameter program 21 supplements this information with product and process data from database 12 to identify individual entity data. The load parameter program uses the combination of test, product and process information to generate descriptions for parameter files 19 which are used by engineers to refine and revise the product. As a result all relevant parameters are grouped in a single data collection operation into the set of parameter files 19. Reference numbers used in FIG. 1 will be used to refer back to throughout the remainder of this section.

FIG. 2 shows a dialog screen used for information collection by the system of FIG 1. A display screen 31 is used to display an interactive query 33 for collection of data to identify a specific entity of a structure type 43. In this example structure type 43 in an N-type MOS transistor. Structure type 43 defines the class of entities to be measured. The information required to delineate a particular entity is portrayed in a query area 35 within the screen. The contents and look-and-feel of query area 35 is dynamically configured based on the criteria for delineating entities and by user requirements. This delineation information for a particular entity of this structure type is recorded in database 12. Test specific information 34 records comments and readable text to supplement the test information obtained from file 14 which was derived from

test engineering. Detail information, for example, transistor parameters 36 include width, length, rotation, and total area of the transistor being tested. This detail information is queried based on delineation criteria retained in database 12. Certain criteria 37 have both an attribute 38 and a predetermined value 39. These are descriptive labels not internal codes and have a selected value for a particular structure description. A list of alternative values 36 allow value 39 to be selected from a list of legal values. Reference numbers used in FIG. 2 will be used to refer back to throughout the remainder of this section.

FIG. 3 shows a matrix describing the interaction of various potential tasks 41 which could be allowed for type 43. A display screen 40 is used to prompt and query the user concerning which entities and associated tests are to be defined as parameters and measured test results. Each entity 42 has a selection cell 44 representing potential tests 41 which could be performed on that entity. The user then uses a point-and-click interface to toggle each selection between a selected cell 44 and an unselected cell 47. Each selected cell 44 identifies a unique combination of an entity and associated tests. Selected cells 44 will have parameter and test descriptions defined in configuration file 18 (FIG. 1). Test generator 16 and load parameter program 21 will generate test programs 17 and parameter files 19 based on the contents of configuration file 18. The relevant information is extracted into an intermediate generic test description 15 which is then used to generate the tester specific test programs 17. Each selected cell 44, unselected cell 47, and undefined cell 46 is a possible parameter representing a test performed on a particular device in a particular entity.

Additional entities for a structure type using undefined cells 46 are easily added by pointing at entity column heading 48 and clicking the mouse button. Upon clicking entity column heading 48, interactive query 33 is displayed. The details for delineating a new entity from existing entities for this structure type are then entered. By clicking on an entity column heading 48 which corresponds to an existing entity 42, interactive query 33 corresponding to that entity 42 is displayed, allowing editing of the previously defined entity information.

Operation of the database system requires defining a class of entities to be measured, in this example structure type 43. A set of criteria which distinguish the desired entities within the class of entities to be measured is defined. Typically this set includes parameters such as width and height of a transistor type. A computer display is used to show the corresponding query area 35 based on the set of criteria, and using the format defined by query area 35. The user interactively specifies values which are related to individual entities using query area 35. The set of measurements 41 which is related to the class of entities to be measured is displayed on the computer screen. The set of measurements is then associated with the set of criteria in database 12.

Parameter labels are generated from selected cells 44 which uniquely identify each association of a measurement with an entity in accordance with the set of criteria which are found in database 12. In addition, the parameter labels are generated using a formatting rule which extracts information from entity 42 and test description 41. A set of associated engineering limits, such as specification limits and control limits, are defined for each labeled parameter and also saved in database 12. A detailed list of parameter components which describe individual criteria for both the measurement and the measured entity is created based on the selected cells 44 associated with that entity. Generic test description 15 is generated based on the detailed list of parameter components, test specific information 34, test description 41, and the parameter labels. The detailed list of components is used to facilitate the selection of desired parameters for analysis of those parameters across all relevant classes. For example this step allows extraction of data related to all N-MOS transistors having a length of 10 microns regardless of other criteria.

By now it should be clear that the present invention provides a method for gathering, storing, and analyzing large amounts of engineering data in an organized fashion. This method is usable at many sites and has flexible configuration options. System configuration consists of loading information into standard database tables. As a result the configuration defines the relationships between the system components as well as the behavior of individual system components.

While specific embodiments of the present invention have been shown and described, further modifications and improvements will occur to those skilled in the art. It is understood that the invention is not limited to the particular forms shown and it is intended for the appended claims to cover all modifications which do not depart from the spirit and scope of this invention.

Claims

1. A method for generically describing measured results, comprising:

   defining a class of entities to be measured;

   defining a set of criteria which distinguish entities within the class of entities to be measured;

   dynamically configuring a computer display format based on the set of criteria;

displaying the set of criteria on a computer display (31) according to the computer display format;

interactively specifying values related to an individual entity;

displaying a predetermined set of measurements on the computer display (31), the set of measurements being the set related to a valid class of entities to be measured; and

associating a predetermined set of measurements with the set of criteria.

2. The method for generically describing measured results of claim 1 further comprising:

generating a plurality of parameter labels, which uniquely identifies each association of a measurement with an entity in accordance with a set of predetermined criteria.

3. The method for generically describing measured results of claim 2 further comprising:

defining a set of associated engineering limits for each of the labeled parameters.

4. The method for generically describing measured results of claim 1 further comprising:

generating a detailed list of parameter components which describe individual criteria for both the measurement and the measured entity.

5. The method for generically describing measured results of claim 4 further comprising:

grouping of a plurality of parameters into a description of a single data collection operation.

6. The method for generically describing measured results of claim 4 further comprising:

generating a generic test description based on the detailed list of components.

7. The method for generically describing measured results of claim 6 further comprising:

generating a tester specific test program based on the generic test description.

8. The method for generically describing measured results of claim 5 further comprising:

using the detailed list of parameter components to facilitate the selection of desired parameters for analysis of those parameters within a plurality of classes.

9. A method for generically describing measured results, comprising:

defining the measurement criteria for each class delineated by component;

defining an entity criteria which defines the entities within each class;

defining a limits criteria for limits associated with each of a plurality of components; and

initializing a computer display (31) based on the measurement criteria, the entity criteria and the limits criteria.

10. A method for generically describing measured results, comprising:

defining the measurement criteria for each class delineated by component;

defining an entity criteria which defines the entities within each class;

defining a limits criteria for limits associated with each of a plurality of components;

initializing a computer display (31) based on the measurement criteria, the entity criteria and the limits criteria;

generating a detailed list of parameter components which describe individual criteria for both the measurement and the measured entity;

grouping of a plurality of parameters into a description of a single data collection operation;

generating a generic test description based on the detailed list of components; and

generating a tester specific test program based on the generic test description.

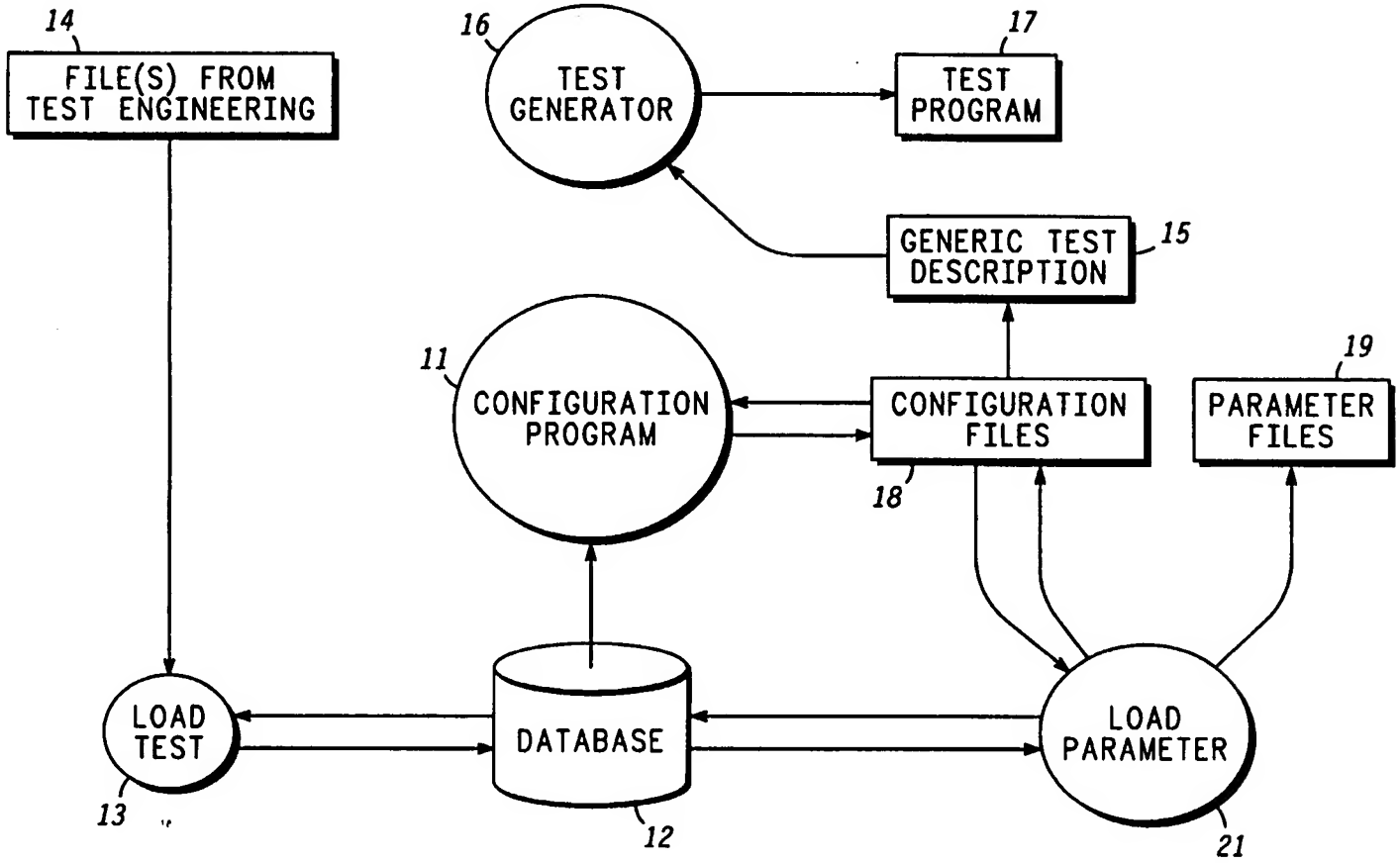

FIG. 1

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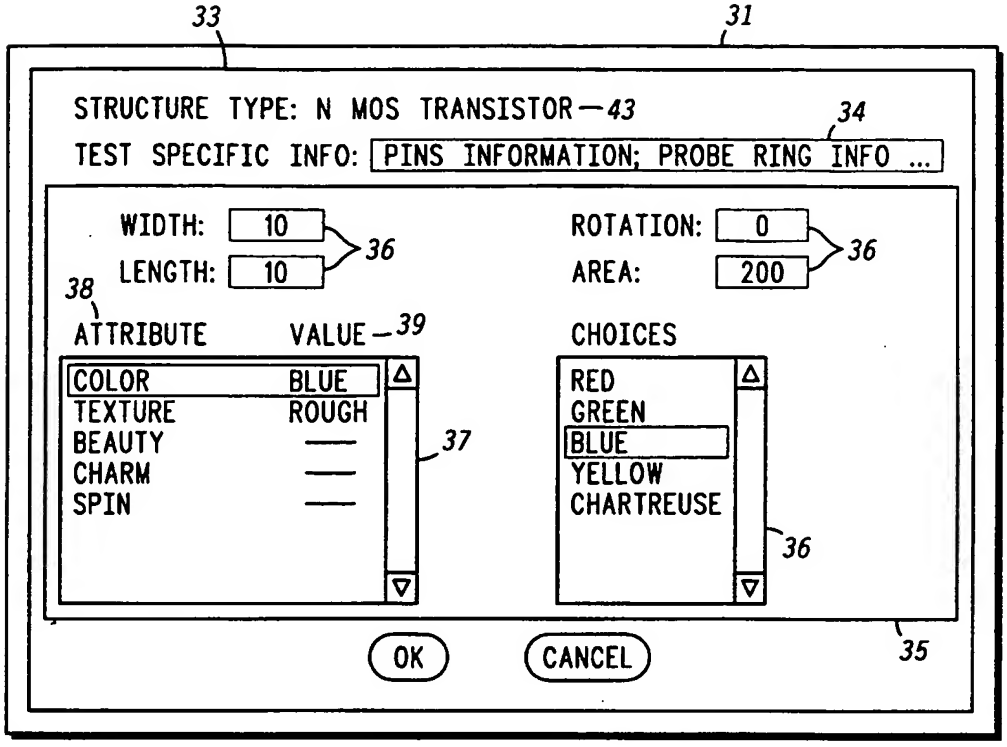
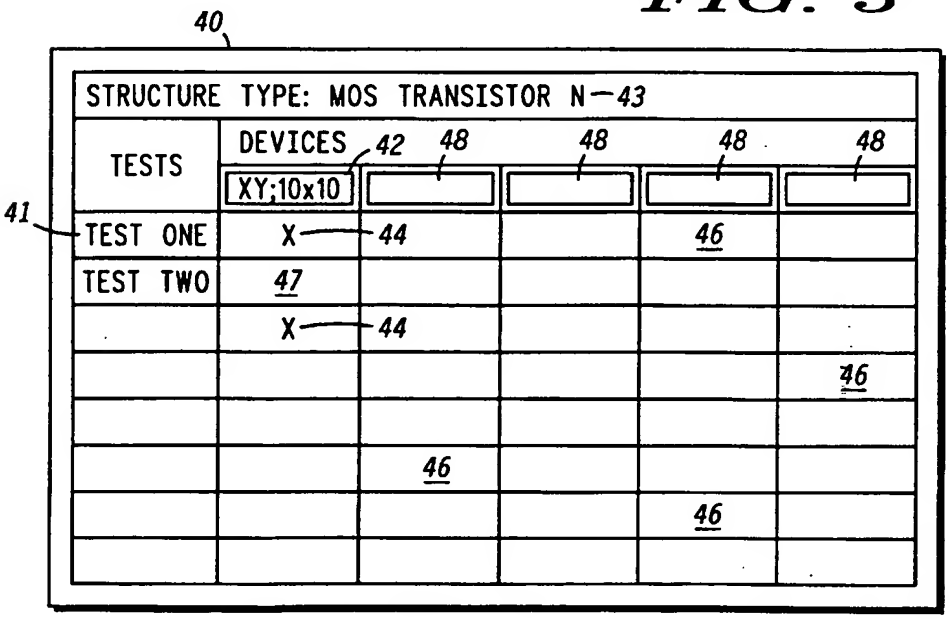


FIG. 2

FIG. 3



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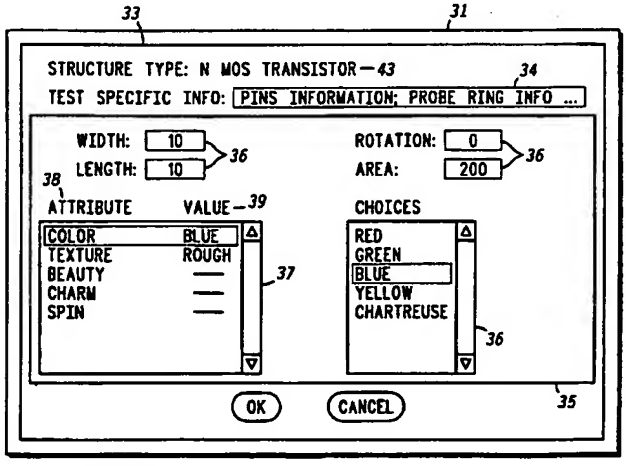

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 95 10 1406

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	GB-A-2 251 321 (VAPOURWARE LIMITED) 1 July 1992 * abstract * * page 5, line 5 - page 11, line 12 *	1,9,10	G06F17/40
A	US-A-4 718 025 (MINOR PAUL S ET AL) 5 January 1988 * column 2, line 53 - column 2, line 68 * * claim 28 *	1,9,10	
A	PATENT ABSTRACTS OF JAPAN vol. 015 no. 122 (P-1184) ,26 March 1991 & JP-A-03 009436 (NEC CORP) 17 January 1991, * abstract *	1,9,10	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

G06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30 November 1995	Suendermann, R

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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